Occultations of Stars by the Moon (visible at Greenwich).

May.	Star.	Mag.	Disap.	Reap.	Corresponding angles from vertex to right for inverted image.	
			h. m.	h. m.	°	°
8 ...	γ Libræ	4½ ...	1 4	near approach	168	—
13 ...	π Capricorni ...	5 ...	3 35 ...	4 57 ...	93	274

GEOGRAPHICAL NOTES.

IN the new number (iv.) of *Petermann's Mitteilungen* we find an interesting note by General Tillo on what he calls the chief water-partings of the earth. He points out that it is usual to indicate for each region the great water-partings, and to come down from that to what are considered as smaller or subordinate water-partings. But it seems to him that, from a general consideration of the earth's surface, the idea of a great world-water-parting may be worked out. This he illustrates by a Polar projection map in which the Old and the New World continents are brought face to face. On this he lays down one continuous line, broken only by Bering's Straits, extending from the south point of America, north along the west side of South and North America, in an irregular diagonal across Asia to the Isthmus of Suez, and down Eastern Africa to the Cape. No doubt there is much to be said for this general conception, especially as General Tillo admits that there are special continental water-partings which do not quite conform to the line of the great parting, though, as a matter of fact, nearly all the great rivers of the world are divided by this parting into two directions. It brings out strikingly the fact that the greater portion of the land-mass of the Old World, and by far the larger portion of the New World are drained into the Polar Atlantic basin.

AMONG the other papers in the new number of *Petermann* is one on the caravan routes between Suakim and Kassala, by Josef Menges. Dr. Ed. Petri contributes a paper of great interest containing some fresh and curious data on the Yakuts, of whose persistence, activity, and culture, he, like others, has formed a high estimate. Dr. Posewitz contributes a first paper on the geological condition of the Island of Billiton, with special reference to mining.

M. CHAFFAUJON has completed his exploration of the Orinoco and returned to Ciudad Bolivar. He states, in a letter dated March 15 last, that he has discovered the sources of the Orinoco, and found that the River Cassiquiari is only a branch of that river, uniting its basin with that of the Amazon; which seems pretty much what we knew before. M. Chaffaujon has sent a complete report of his exploration to the French Minister of Public Instruction, as well as some ethnographical curiosities, and a fairly complete collection of the fishes of the Orinoco.

AT a recent meeting of the Hungarian Geographical Society, Herr Moriz Von Déchy gave an account of his exploration of the Caucasus last year, in company with the geologist Dr. Schafurzik. The exploration has been rich in scientific results. Besides taking numerous observations on glaciers, measurements of heights, and many fine photographs, the explorers have brought back with them large collections, which have been deposited in the Museum of the Society, the University of Buda-Pesth, and the Hungarian Geological Institute. There are eighteen boxes of rocks and minerals. There is a small collection of beetles, and several highly interesting and valuable macrocephalic skulls. These, with the large collection of plants obtained in the Expedition of 1885, will be of the highest value to writers on the geology and natural history of this interesting region.

IT is stated in Copenhagen that an Expedition will be despatched late this summer by Herr A. Gamil, the equipper of the *Dijmphna* Expedition of 1882, to the north-east coast of Greenland. It is hoped that the explorers may reach a higher latitude than that attained by Lieut. Holm in 1884, and discern the "Sound" described by the East Greenlanders as running from the east to the west coast, somewhere in latitude 78° N. The Expedition will, if it starts, be commanded by Lieut. Hovgaard, who in 1882 commanded the *Dijmphna*.

FRANCE has succeeded in moving the eastern boundary of her Congo territory from the somewhat uncertain River Licona to the magnificent Mobangi. According to the *Times* Paris Correspondent, the *Thalweg* of the Mobangi is to be the boundary between the French territories and the Congo Free State; but how far up the Mobangi the boundary goes we are not informed. As, by the Berlin Treaty, we understand France cannot go farther north than 4° N. lat., we do not see that she gains much by this new boundary, should the Mobangi turn out, as is probable, to be identical with the Wellé. Had the Paris Correspondent taken the trouble to look at a map, he would not have told us that by this new advance France becomes mistress of the greater part of the Congo basin; the statement is absurd.

WE are glad to learn of the safety of Mr. Carey, to whose extensive journeys in Central Asia we referred in a previous number. He has wintered at Hami, and is by this time probably well on his way to India.

THOSE interested in Dr. Junker will find a very full statement of his work, with a map, in the new number of the Proc. R.G.S., by Mr. J. T. Wills. Dr. Junker's travels in the Soudan and Central Africa have lasted from the spring of 1876 to the end of 1886, with the exception of about a year and a half in 1878–80. In his first journey he found the sources of the Wellé-Makua near Lake Albert Nyanza. In 1880–83 he explored the basin of the Makua and Kuta (probably the Upper Mobangi).

THE Government of Victoria are preparing to send out a well-equipped expedition to explore the Owen Stanley Range of New Guinea, from Port Moresby, and have, we learn from the Proc. R.G.S., offered the leadership to the man of all others best able to carry out so difficult an undertaking to a successful issue—the Rev. J. Chalmers.

A FURTHER step has been taken in promotion of an expedition towards the South Pole, by the colony of Victoria. Acting on an offer made by Sir Allen Young to lead such an expedition, it is stated that Sir Graham Berry has brought the question of a Government grant towards the cost of the enterprise before the Victorian Cabinet, and that the matter is being urged forward with a view to the expedition starting from Hobson's Bay in October or November next.

THE WORK OF THE IMPERIAL INSTITUTE.[1]

II.

WHILE extolling the comprehensive and well-organised sytems of technical education existing in all parts of the Continent and the United States, let us not undervalue the great progress which has been made in recent years in Great Britain in the advancement and extension of technical instruction. The Royal Commission on the Depression of Trade and Industry state, as the result of evidence collected by them, that "It would be difficult to estimate the extent to which our industries have been aided in various ways by the advance of elementary, scientific, and technical education during the last twenty years."

The important influence exercised by the admirable work which the organisation of the Science and Art Department has accomplished, upon the intellectual and material progress of the nation, is now thoroughly recognised. Prof. Huxley, the Dean of the Normal School of Science, in his recent important letter "On the Organisation of Industrial Education," has reminded us that "the classes now established all over the country in connexion with that Department, not only provide elementary instruction accessible to all, but offer the means whereby the pick of the capable students may obtain in the schools at South Kensington as good a higher education in science and art as is to be had in the country," and "that it is from this source that the supply of science and art teachers is derived, who in turn raise the standard of elementary education" provided by the School Boards. The extension of facilities for the education of those engaged in art-industries is constantly aimed at, as was recently demonstrated by the creation of free studentships for artisans in the Art Schools at South Kensington.

The necessity which has gradually made itself felt in the manufacturing towns of the United Kingdom for encouraging the study of science in its application to industries, by those who intend to devote themselves to some branch of manufacture or trade, has led to the establishment in about twenty-five towns in England and Scotland, and in two or three in Ireland, of colleges of science corresponding more or less to the Continental polytechnic schools, and accomplishing important work in training students in the different branches of science in their applications to manufactures and the arts.

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[1] Lecture (abridged) delivered at the Royal Institution, on Friday, April 22, by Sir Frederick Abel, C.B., F.R.S.; H.R.H. the Prince of Wales, K.G., F.R.S., Vice-Patron, in the Chair. Continued from vol. xxxv. p. 621.

The wealthier of the City Companies, some of which had long been identified with important educational establishments, associated themselves with the Corporation of the City of London nearly ten years ago to establish an organisation for the advancement of technical education, which has already carried out most important work. The Society of Arts, which initiated the system of examinations, afterwards so successfully developed by the Science and Art Department, set on foot and conducted for several years examinations of artisans in a few branches of technology. This useful work was relinquished in 1879 to the City and Guilds Institute, and its gradual extension since that period has been attended with most satisfactory results. The beneficial influence exercised by the examinations upon the development and extension of technical instruction in the manufacturing districts throughout the country being already very marked. The adoption of the system, originated by the Science and Art Department, of contributing to the payment of teachers in proportion to the successes attained by their pupils, is operating most successfully in promoting the establishment and extension of classes for instruction in technical subjects, in connexion with Mechanics' Institutes and other educational establishments in various centres of industry.

The Technical College at Finsbury was the first great practical outcome of the efforts made by the City and Guilds Institute to supplement existing educational machinery, by the creation of technological and trade schools in the metropolis, and the results, in regard to number and success of students at the day and evening schools of that important establishment, have afforded conclusive demonstration of the benefits which it is already conferring upon young workers who, with scanty means at their command, are earnest in their desire to train themselves thoroughly for the successful pursuit of industries and trades. The evening courses of instruction are especially valuable to such members of the artisan classes as desire, at the close of their daily labour, to devote time to the acquisition of scientific or artistic knowledge.

Another department of the City and Guilds Institute, of a somewhat different character, is the South London School of Technical Art, which is also doing very useful work, while the chief or Central Institution for Technical Education, which commenced its operations about three years ago, if it but continue to be developed in accordance with the carefully matured scheme which received the approval of the City and Guilds Council, and with that judicious liberality which has been displayed in the design and arrangement of the building, bids fair to become the Industrial University of the Empire.

As one of the first students of that College of Chemistry which became part-parent of our present Normal School of Science, and the creation of which (forty-two years ago) constituted not the least important of the many services rendered towards the advancement of scientific education in this country by His Royal Highness the Prince Consort, most vividly I remember the struggling years of early existence of that half-starved but vigorous offspring of the great school of Liebig, born in a strangely unsympathetic land in the days when the student of science in this country still met on all sides that pride of old England, the practical man, inquiring of him complacently: *cui bono? quo bono?* That ardent lover of research and instruction, the enthusiastic and dauntless disciple of Liebig—my old master—Hofmann, loyally supported through all discouragement, and in the severest straits, by a small band of believers in the power of scientific research to make for itself an enduring home in this country, succeeded in very few years in developing a prosperous school of chemistry which soon made its influence felt upon British industry; and it is not credible that less important achievements should be accomplished, and less speedily, in days when the inseparable connexion of science with practice has become thoroughly recognised, by an Institution created, and launched under most auspicious circumstances, by those powerful representatives of the commercial and industrial prosperity of the Empire, who, before all others, must realise the vital necessity for ceaseless exertions, even for much self-sacrifice in the immediate present, to recover our lost ground in the dominions of industry.

One of the most important functions of the Central Technical College should consist in the thorough training of teachers of applied science. The statistics furnished by the technological examinations show that, while their successful organisation has led to the establishment of classes of instruction, supplementary to the general science teaching in every large manufacturing centre, the increase in the number of candidates examined has been accompanied by an increase in the percentage of failures to pass the examinations, and that the supply of a serious deficiency in competent teachers was essential to a radical improvement in technical education. The work of the City and Guilds Institute in this direction has already been well begun, and it is in the furtherance of this, by the organisation of arrangements for facilitating the attendance of science teachers for sufficient periods at the Central Institute, or at more accessible provincial technical colleges, that the Imperial Institute may hope to do good work.

Without taking any direct part in the duty of education, it is contemplated that the Imperial Institute will actively assist in the thorough organisation of technical instruction, and its maintenance on a footing, at least of equality, with that provided in other countries, by the system of intercommunication which it will establish and maintain between technical and science schools; by the distribution of information relating to the progress of technical education abroad, to the progressive development of industries, and the requirements of those who intend to pursue them; by the provision of resources in the way of material for experimental work, and illustrations of new industrial achievements, and by a variety of other means.

The provision of facilities to teachers in elementary schools to improve their knowledge of science and their power of imparting information of an elementary character to the young, constitutes another direction in which important progress may be made towards establishing that continuity between elementary and advanced education which is so well developed on the Continent. The organisation of facilities, combined with material aid, to be provided to young artisans who shall afford some legitimate evidence of superior natural intelligence, and a striving after self-improvement, to enable them to abandon for a time the duty of bread-winning, and to work at one or other of the technical schools in London or the provincial centres, will be another object to which the resources of the Imperial Institute should be applied very beneficially. Not only will the intelligent workman's knowledge of the fundamental principles of his craft or trade be thereby promoted; his association in work and study with others who are pursuing the acquisition of knowledge in different directions, which at first seem to him alien to his personal pursuits and tastes, but come in time to acquire interest or importance in his eyes, will bring home to him the advantages of a wider and more comprehensive scope of instruction, and the enlargement of his views regarding the value and pleasure of knowledge will, in turn, exercise a favourable influence in the same direction upon those with whom he afterwards comes into contact. The cramping influence which the great subdivision of labour, resulting from the development of mechanical, physical, and chemical science, is calculated to favour, must thus become counteracted, and the workman will realise that if he is to rise above the level of the ordinary skilled labourer, mere dexterity in the particular branch of that trade which he has made his calling must be supplemented by an acquaintance with its cognate branches, by some knowledge of the principles which underlie his work, and by some familiarity with the trades allied to his calling.

The importance of bringing technical instruction within the reach of the needy scholars of the lower middle class need not be dwelt upon, and there can be no question that one of the most powerful means of promoting the extension of technical education will be the well-organised administration of a really comprehensive system of scholarships, to be judiciously utilised in connexion with the well-established colleges and schools of science and technics throughout the country, in such proportions as to meet local requirements and changing conditions. That a good foundation for such a system of scholarships is likely ere long to emanate from the resources of the Royal Commission of 1851, has already been officially indicated in one of its reports; may we not also hope that many will be found in our Empire ready to follow the example of the late Sir Joseph Whitworth, and to act in emulation of the patriotism of those men who, by munificent donations or endowments in aid of the work of bringing industrial education within the reach of all classes in the United States, have helped to place our cousins in the position to hold their own and aspire to victory, in the war of industry? The thoroughly representative character which it is intended to maintain for the governing body of the Imperial Institute will secure the wise administration by it of funds of this kind, dedicated to the extension and perfection of national establishments for technical education, and to the encouragement of its pursuit, in the ways above indicated, by those whose circumstances would otherwise prevent them from enjoying the advantages secured to their fellow-workers in other countries. Several other directions readily suggest themselves in which the judicious administration of resources in aid of the technical training of eligible men of the the artisan class could well form part of the organised work of the Imperial Institute.

By the establishment of an Education branch of the Intelligence Department, which will form a very prominent section of the Imperial Institute, the working of the colleges and schools of applied science in all parts of the United Kingdom will be harmonised and assisted, and the information continuously collected from all countries relating to educational work and the application of the sciences to industrial purposes and the arts will be systematically distributed. A well-organised Inquiry Department will furnish to students coming to Great Britain from the colonies, dependencies, and India, the requisite information and advice to aid them in selecting their place of work and their temporary home, and in various other ways. The collections of natural products of the colonies and India, maintained up to the day by additions and renewals at the central establishment of the Institute, will be of great value to students in the immediately adjacent educational institutions, and will, moreover, be made subservient to the purposes of provincial industrial colleges by the distribution of thoroughly descriptive reference catalogues, and of specimens. Supplies of natural products from the Colonies, India, or from other countries, which are either new or have been but imperfectly studied, will be maintained, so that the material may be readily provided to the worker in science or the manufacturer, either for scientific investigation or for purposes of technical experiment.

The existence of those collections and of all information relating to them, as well as of the libraries of technology, inventions, commerce, and applied geography, in immediate proximity to the Government Museums of Science and Inventions, Art, and Natural History, to the Normal School of Science, and to the Central Technical Institute, present advantages so obvious as to merit some fair consideration by those who have hitherto declined to recognise any reason in favour of the establishment of the Imperial Institute at South Kensington.

In the powerful public representations which have of late been made on the imperative necessity for the greater dissemination and thorough organisation of industrial education, the importance of a radical improvement in commercial education, as distinguished from what is comprehended under the head of technical training, has scarcely received that prominence which it merits. It is true that, in some of our colleges, there are courses of instruction framed with more especial reference to the requirements of those who propose to enter into mercantile houses, or in other ways to devote themselves to commercial pursuits; but as a rule the mercantile *employés*, embraced under the comprehensive title of clerks, begin their careers in life but ill prepared to be more than mechanical labourers, and remain greatly dependent upon accident, or upon their desire for self-improvement which directs them in time to particular lines of study, for their prospects of future success in commercial life.

This impressed itself strongly upon the Royal Commission on the Depression of Trade and Industry, who state as the result of evidence collected by them that our deficiency in the matter of education as compared with some of our foreign competitors relates "not only to what is usually called technical education, but also to the ordinary commercial education which is required in mercantile houses." The ordinary clerk in a merchant's office is too often made to feel his inferiority to his German colleague, not merely in regard to his lamentable deficiency in the knowledge of languages, but in respect to almost every branch of knowledge bearing upon the intelligent performance of his daily work and upon his prospect of advancement. The preliminary training for commercial life on the Continent is far more comprehensive, practical, and systematic than that which is attainable in this country, and the student of commerce abroad has, afterwards, opportunities for obtaining a high scientific and practical training at distinct branches of the polytechnic schools and in establishments analogous to the technical colleges such as the High Schools of Commerce in Paris, Antwerp, and Vienna.

It will be well within the scope of the Imperial Institute, as an organisation for the advancement of industry and commerce, to promote a systematic improvement and organisation of commercial education by measures analogous to those which it will bring to bear upon the advancement of industrial education.

The very scant recognition which the great cause of technical education has hitherto received at the hands of our administrators has, at any rate, the good effect of rousing and stimulating that power of self-help which has been the foundation of many achievements of greatest pride to the nation, and we may look with confidence to the united exertions of the people of this country, through the medium of the representative organisation which they are now founding, for the early development of a comprehensive national system of technical education, of the nature foreshadowed not long since by Lord Hartington, in that important address which has raised bright hopes in the hearts of the apostles of education.

In connexion with some of the views which have been of late put forward regarding the possible scope of the Imperial Institute, the antagonism which has been raised and fostered against its location in the vicinity of some of our national establishments most intimately connected with the educational advancement of the Empire, has developed a tendency to circumscribe its future sphere of usefulness, and to place its functions as a great establishment of reference and resort for the commercial man in the chief foreground. I have endeavoured to indicate directions in which its relations to the Colonies and India, to the great industries of the country, and to the advancement of technical and commercial education, cannot fail to be at least as important as its immediate connexion with the wants of the commercial section of the community, and those are most certainly quite independent of the particular locality in which it may be placed, excepting in so far as the command of ample space, and the advantages to be derived from juxtaposition with the great national establishments to which I have referred, is concerned. At the same time, there is not one of the directions in which the development of the resources and activity of the Institute has been thus far indicated, which has not an immediate and important bearing upon the advancement of the commerce of the Empire. There are, however, special functions to be fulfilled by the Institute, which are most immediately connected alike with the great commercial work of the City of London and with that of the provincial centres of commerce. The provision, in very central and readily accessible positions, of commercial museums or collections of natural or import products, and of export products of different nations, combined with comprehensive sample-rooms and facilities for the business of inspection, or of commercial, chemical or physical examination, is a work in which the Institute should lend most important aid. The system of correspondence with all parts of the Empire which it will develop and maintain will enable it to collect and form a central depot of natural products from which local commercial museums can be supplied with complete, thoroughly classified economic collections, and with representative samples of all that, from time to time, is new in the way of natural products from the Colonies and Dependencies, from India, and from other countries. In combination with this organisation, the distribution to commercial centres of information acquired by a central department of commercial geography will constitute an important feature in the work of the Institute, bearing immediately upon the interests of the merchant at home, in the Colonies, and in India.

The formation of specially commercial institutions, of which inquiry offices, museums, and sample-rooms with their accessories, will form a leading feature, and which will supply a want long since provided for by the nations with whom we compete commercially, is already in contemplation in the Cities of London and Newcastle; other great commercial centres will also doubtless speedily take steps to provide accommodation for similar offshoots from the central collections of the Institute. So far as the Indian Empire is concerned, the organisation of correspondence by provincial committees which already exists in connexion with economic and geological museums established in the several Presidencies, affords facilities for the speedy elaboration of the contemplated system of correspondence in connexion with the Institute, and the establishment of similar organisations in the different Colonies will, is is hoped, be heartily entered upon and speedily developed.

The system of correspondence to which I have more than once alluded in indicating some of the work of the Institute, in relation to technical education and industry, and which will form a most important part of the main groundwork of its organisation, is not in the least theoretical in its character. Its possible development has suggested itself to many who have given thought to the future sphere of action of the Institute in connexion with commerce and industry; to myself, who for many years have been, from time to time, officially cognisant of the work performed by what are called the Intelligence Departments of the Ministries of War abroad and at home, the direct and valuable bearing of such a system upon the work of the Institute, suggested itself as soon as I gave thought to the possible future of this great conception, and to Major Fitzgerald Law belongs the credit of suggesting that the well-tried machinery of the War Office Intelligence Department should serve as a guide for the elaboration of a Commercial Intelligence Department. This Department, which will, it is hoped, ere long commence its operations by establishing relations with the chief colonies and India, will be in constant communication with the Inquiry Offices to be attached to the local commercial establishments and to other provincial representations of the work of the Institute, systematically distributing among them the commercial information and statistics continually collected. It will be equally valuable to the colonies and India by bringing their requirements thoroughly to the knowledge of the business men in the United Kingdom, and by maintaining that close touch and sympathy between them and the people at home which will tend to a true federation of all parts of the Empire.

In no more important direction is this system destined to do useful work than in the organisation of emigration, not only of labour, but also of capital. The establishment of emigration inquiry offices at provincial centres in connexion with a central department at the Institute, will be of great service to the intending emigrant, by placing within his reach the power of acquiring indispensable information and advice, and by facilitating his attainment of the special knowledge or training calculated to advance his prospects in the new home of his choice. Similarly, the capitalist may be assisted in discovering new channels for enterprise in distant portions of the Empire, the resources of which are awaiting development by the judicious application of capital and by the particular class of emigration which its devotion to public works or manufacturing enterprise in the Colonies would carry with it. The extent to which the State may aid in the organisation of systematic emigration, and the best mode in which it may, without burden to the country, promote the execution of such public works in the Colonies as will open up their dominions to commerce and at the same time encourage the particular class of emigration most advantageous to the Colonies themselves, are subjects of great present interest; but, in whatever way these important questions may be grappled with, such an organisation as the Institute should supply cannot fail to accelerate the establishment of emigration upon a sound and systematic footing, and to co-operate very beneficially in directing private enterprise into the channels best calculated to advance the mutual interests of the capitalists and the colonies.

I have already indicated that it is not only in connexion with purely commercial matters that the Intelligence Department of the Institute will occupy itself. The prospects of its value to the Colonies and to India in promoting the development of their natural resources and the cultivation of new fields for commercial and industrial activity are well illustrated by the valuable work which has been accomplished upon similar lines by the admirably directed organisation at Kew.

By the systematic collection and distribution of information relating to industries and to education from all countries which compete with ourselves in the struggle for supremacy in intellectual and industrial development, the Institute will most importantly contribute to the maintenance of intimate relationship and co-operation between educational, industrial, and commercial centres, between the labourer in science and the sources through which his work becomes instrumental in advancing national prosperity; between the Colonies and the Mother Country, between ourselves and all races included in the vast Empire of Her Majesty.

In conclusion, I venture to express the belief that the organisation which the Imperial Institute will have the power of developing, with a wisely constructed governing body at its head, may accomplish, and at no distant date, other most useful work, which has been already publicly indicated as destined to have an immediate bearing upon the federation of England and her colonies. Prof. Huxley, in his last Presidential Address to the Royal Society, uttered most suggestive words, indicative of the value and the possibility of a *scientific* federation of all English-speaking peoples; and this subject is now receiving the careful consideration of that Society. It is firmly believed by leading men of science that such a federation of at any rate the Colonies and Dependencies with us will be brought about, and it is in harmony with that belief that the Imperial Institute should be expected, through its organisation, to afford important aid in the application of the principle of federation to the geological and topographical survey of the Colonies, in the establishment of a system of interchange of meteorological and scientific observations, and in the promotion, in various ways, of thorough co-operation between particular Colonies, or groups of Colonies, for applying the results of scientific research to the mutual development of their natural resources.

It may be that the programme of which I have given a very imperfect exposition, as indicative of the work which the Imperial Institute may be called upon to accomplish, will be regarded by some as almost too ambitious in its scope for practical fulfilment. The outline of this programme has been drawn by a combination of abler hands than mine; I have but ventured to sketch in some of the details as they have presented themselves to my mind, and to the minds of others who have given thought to this great subject; but I dare to have faith in its realisation, and to believe that, if the work be taken in hand systematically and progressively, the nucleus being first thoroughly established from which fresh lines of departure will successively emanate, the Imperial Institute is destined to become a glory of the land. And, as one whose mission it has been, through many years of arduous work, to assist in a humble way in the application of the resources of some branches of science to the maintenance of the country's power to defend its rights and to hold its own, I may perhaps be pardoned for my presumption in giving expression to the firm belief that, by the secure foundation and careful development of this great undertaking, and by its wise direction, by a government truly representative of its founders—all Nations and Classes composing the Empire—there will be secured in it one of the most important future defences of the Queen's dominions; one of the most powerful instruments for the maintenance of the unity, the strength, and the prosperity of her realms.

THE LOCOMOTOR SYSTEM OF STAR-FISH.

PROF. PREYER, of Jena, has recently concluded an elaborate research "Ueber die Bewegungen der Seesterne." This paper, which contains over thirty illustrations, appears in the Publications of the Zoological Station at Naples (vii.), where the investigation was carried on during a period of nearly five months. This investigation was exclusively physiological, and confined to the star-fish—the Holothurians, Echini, &c., not having fallen within its scope. Considering that Prof. Preyer thus selected a line of experimental inquiry which had been already pretty well worked out, he deserves to be congratulated on the everywhere interesting and frequently novel character of his results. The most important of these results, in so far as they are new, appears to me—as also to himself—to be his demonstration that a severed ray of a star-fish exhibits much more co-ordination in the management of its tube-feet, if the section has been arranged so that two or more of the central ganglia in the disk are left in connexion with the ray, than if only one of these ganglia be so left. It was previously known that under any circumstances the severed ray of a star-fish would not only crawl about, seek the light, &c., but also right itself when turned over on its back. In order to execute this manœuvre highly co-ordinated action on the part of the tube-feet is required, and therefore the interest attaching to Prof. Preyer's observation consists in its having shown that this co-ordination cannot be nearly so well effected by one of the central ganglia as it can be by two or more of them. Or, in his own words, "Also leisten 2 functionell gleichwerthige Theile des Nervensystems zusammen qualitativ mehr als jeder für sich. Man kommt auf die Vermuthung, dass auch bei den höheren Thieren, und vielleicht auch dem Menschen, es nicht allein die qualitative Beschaffenheit der Ganglienzellen, sondern auch ihre Anzahl und Verbindung ist, welche höhere psychische Leistungen ermöglichen."

Highly interesting also are the results of numerous ingenious experiments devised with a view of testing whether the adaptive movements of star-fish can be explained as due to mechanical reflexes alone, or require us to suppose something of the nature